Waferlevel Chip Scale Packaging Fluxes for Microsphere Bumping

Introduction

Until recently, there have been two standard processes for bumping wafers with solder: solder paste printing and solder plating. The limitations of these processes have led to the development of a third, more flexible, method that has two stages: flux printing (usually by stencil or screen), followed by solderball placement. This process is reported to be in production in Asia at the 90micron soldersphere diameter level (200micron pitch), with extensibility down to at least 60microns (130micron pitch).

Considerations	Solder paste printing	Plating	Flux / Soldersphere Printing
High Volume Manufacturing	◎	◎	○
Alloy Restrictions	◎	△	◎
Bump Size	△	◎	○
Bump Uniformity	△	◎	○
Voiding	△	○	◎
Cost	○	△	△
Prototyping	○	△	○

Key:
- ◎ No problems
- ○ Some problems known
- △ Significant barriers

Fluxes suitable for use in this new soldersphere process must have the following capabilities:

Retain Solderspheres

Solderspheres must be held in place during all process steps after placement: particularly during handling and reflow.

Consistent Solderability

Consistent sphere size and consistent solderability in a low oxygen (typically less than 50ppm oxygen) reflow environment are the two key elements to reducing bump height variablity that can lead to “opens” during the subsequent flip-chip process.

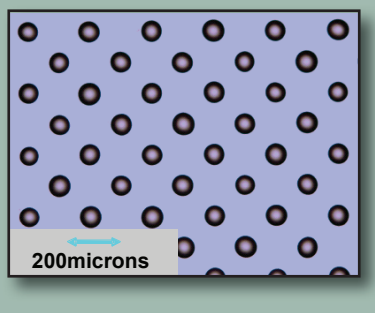
Compatibility with Underfill

After reflow, the bumped chip will be used in a diret chip attach (flip-chip) assembly proces that typically requires the usage of a capillary underfill material. There must therefore be zero residu after cleaning, or any residue must be completely compatible with the underfill and also present in such small quantities that it does not block the flow of underfill under the chip.

Typically, the wafer-level flux is either:
- Water-soluble: leaving zero residues
- No-clean: with ultralow residues (ULR), typically less than 10% by weight

Consistent Printability

Depending on the sphere size and alloy type, a flux deposit of 15-35% of the volume of the sphere is sufficient to retain the sphere in place without. Consistent printing of the flux necessitates use of a Semiconductor Grade flux, which guarantees homogeneity. The picture below illustrates the flux printablity for a Wafer-level CSP flux.



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Indium Corporation Waferlevel Chip Scale Fluxes

The two Indium Corporation Semiconductor Grade materials designed for use in these processes are the two wafer-level chip-scale fluxes WS3622 and NC510.

Flux Name	WS3622	NC510
Flux Type	Water-washable	No-clean
Flux Classification	ORH1	ORL0
Halogen-free	No	Yes
Residue Level	None	<4%
Print Resolution	Down to 100microns	Down to 50microns
Viscosity*	9kcps	67kcps
Tack*	570grams	230gram
Shelf-life	6months**	12months***
Packaging	30cc syringes: bubble-free	30cc syringes: bubble-free

* *Per J-STD-005A*
** *-20degC to +5degC*
*** *+5degC to 30degC*

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